

ABSTRACT

Techniques for super broadband operation of a long wavelength free-electron laser (FEL) on a non-relativistic electron beam are described. Because of the physical nature of the underlying instability, a frequency region within which amplification or generation of the electromagnetic waves occurs, ranges from frequencies slightly below to many times above the resonant FEL frequency. Therefore, in this regime, the device operating frequency is determined by the frequency characteristics of a device resonator and can be tuned over a wide range without changing the electron beam energy or wiggler period. The upper limit of the frequency band is imposed by the thermal spread in an electron beam. Although this regime cannot be understood (and, consequently, was not discovered) without using the relativistic equation of motion, the regime does not rely upon relativism of an electron beam. A non-relativistic implementation of this regime in a submillimeter/THz device is advantageously described.